

What is claimed is:

1 1. A system stream creating apparatus for creating a system  
2 stream, the system stream being a sequence of fixed-length packs,  
3 each pack storing a piece of video stream data, the video stream  
4 data being a sequence of picture data, the system stream creating  
5 apparatus comprising:

6 a stream data transfer unit operable to extract a piece  
7 of picture data having a size of a payload from the video stream  
8 data and store the piece of picture data into a fixed-length  
9 pack;

10 a header data generating unit operable to write a  
11 specified time in a header of the pack storing the piece of  
12 picture data, the specified time indicating a time when the piece  
13 of picture data of the pack is to be input to a video decoder  
14 buffer of a decoding apparatus;

15 a condition judging unit operable to judge, when the  
16 header data generating unit writes the specified time, whether a  
17 difference between (1) a total number of pieces of picture data to  
18 be stored in the video decoder buffer up to the specified time and  
19 (2) a total number of pieces of picture data to be decoded by the  
20 decoding apparatus up to a unit time before the specified time has  
21 reached a predetermined value;

22 a time updating unit operable to update the specified  
23 time; and

24 a stop/resume control unit operable to, when the

25 condition judging unit judges that the difference has reached the  
26 predetermined value, cause the header data generating unit not to  
27 write the specified time and cause the stream data transfer unit  
28 to stop storing the piece of video stream data, and when having  
29 caused the header data generating unit not to write and having  
30 caused the stream data transfer unit to stop storing, cause the  
31 time updating unit to update the specified time and cause the  
32 condition judging unit to judge whether the difference calculated  
33 using the updated specified time has reached the predetermined  
34 value, and when the condition judging unit makes the judgement  
35 negatively, cause the header data generating unit to write the  
36 specified time and cause the stream data transfer unit to resume  
37 storing the piece of video stream data.

1 2. The system stream creating apparatus of Claim 1, wherein  
2 the decoding apparatus decodes one piece of picture data  
3 every video frame cycle,  
4 the unit time is one second, and  
5 the predetermined value is lower than a result of a  
6 division of one second by one video frame cycle.

1 3. A recorder system comprising:  
2 the system stream creating apparatus of Claim 2; and  
3 a recording apparatus which records a system stream  
4 generated by the system stream creating apparatus onto a record

5 medium.

1 4. The recorder system of Claim 3 further comprising:

2 a reading apparatus which reads the system stream from  
3 the record medium; and

4 a decoding apparatus which decodes the system stream  
5 read by the reading apparatus.

1 5. A system stream creating apparatus for creating a system  
2 stream, the system stream being a sequence of fixed-length packs,  
3 each pack storing a piece of video stream data, the video stream  
4 data being a sequence of picture data, the system stream creating  
5 apparatus comprising:

6 a stream data transfer unit operable to extract a piece  
7 of picture data having a size of a payload from the video stream  
8 data stored in a video buffer and store the piece of picture data  
9 into a fixed-length pack;

10 a header data generating unit operable to write a  
11 specified time in a header of the pack storing the piece of  
12 picture data, the specified time indicating a time when the piece  
13 of picture data of the pack is to be input to a video decoder  
14 buffer of a decoding apparatus;

15 a condition judging unit operable to judge, when a piece  
16 of picture data having a size of payload is extracted from the  
17 video buffer and stored into a fixed-length pack, whether an

18 amount of data stored in the video buffer would be lower than or  
19 equal to a predetermined value if the piece of picture data having  
20 the size of payload were stored into the video buffer, using a  
21 model of change in the amount of data stored in the video buffer,  
22 the model being made on an assumption that picture data is input  
23 to the video buffer every certain time and a piece of picture data  
24 included in each pack is output from the video buffer at a  
25 specified time written in a header of each pack;

26 a time updating unit operable to update the specified  
27 time; and

28 a stop/resume control unit operable to, when the  
29 condition judging unit judges that the amount of data would be  
30 lower than or equal to the predetermined value, cause the header  
31 data generating unit not to write the specified time and cause the  
32 stream data transfer unit to stop storing the piece of picture  
33 data, and when having caused the header data generating unit not  
34 to write and having caused the stream data transfer unit to stop  
35 storing, cause the time updating unit to update the specified time  
36 and cause the condition judging unit to judge whether the amount  
37 of data stored in the video buffer would be lower than or equal to  
38 the predetermined value, and when the condition judging unit  
39 judges that the amount of data would exceed the predetermined  
40 value, cause the header data generating unit to write the  
41 specified time and cause the stream data transfer unit to resume  
42 storing the piece of picture data.

1 6. The system stream creating apparatus of Claim 5, wherein  
2 the certain time is a video frame cycle or a slice  
3 cycle.

1 7. The system stream creating apparatus of Claim 6 further  
2 comprising:

3 a picture number judging unit operable to judge, when  
4 the stream data transfer unit stores a next piece of picture data  
5 into the pack, whether a total number of pieces of picture data in  
6 the pack has reached a predetermined number; and

7 a transfer control unit operable to, when the picture  
8 number judging unit has judged positively, cause the stream data  
9 transfer unit to stop storing the next piece of picture data and  
10 store dummy data into the pack.

1 8. The system stream creating apparatus of Claim 7, wherein

2 the transfer control unit causes the stream data  
3 transfer unit to store the next piece of picture data into another  
4 pack.

1 9. The system stream creating apparatus of Claim 8 further  
2 comprising:

3 a video encoding unit operable to generate picture data  
4 by compressing a video signal when the picture number judging unit

5 has judged negatively, and generating as many next start codes as  
6 correspond to remaining space of the pack as the dummy data when  
7 the picture number judging unit has judged positively, wherein  
8 the stream data transfer unit stores either the picture  
9 data or the next start codes generated by the video encoding unit  
10 into the pack.

1 10. A system stream creating apparatus for creating a system  
2 stream, the system stream being a sequence of fixed-length packs  
3 the system stream creating apparatus comprising:  
4 a video encoding unit operable to generate picture data  
5 and when having generated a last piece of picture data of a GOP,  
6 generate as many next start codes as correspond to remaining space  
7 of a pack which stores the last piece of picture data; and  
8 a stream data transfer unit operable to store either the  
9 picture data or the next start codes generated by the video  
10 encoding unit into a fixed-length pack.

1 11. A system stream creating apparatus for creating a system  
2 stream, the system stream being a sequence of fixed-length packs,  
3 each pack storing a piece of either video stream data or audio  
4 stream data, the video stream data being a sequence of picture  
5 data, the audio stream data being a sequence of audio frames, the  
6 system stream creating apparatus comprising:  
7 a stream data transfer unit operable to extract either

8 a piece of picture data having a size of a payload from the video  
9 stream data or an audio frame from the audio stream data and store  
10 the extracted picture data or audio frame into a fixed-length  
11 pack; and

12 a transfer control unit operable to control the stream  
13 data transfer unit so that a group of audio frames provided  
14 through a plurality of channels and having the same presentation  
15 time in common are stored in a group of packs which have been  
16 generated successively.

1 12. The system stream creating apparatus of Claim 11 further  
2 comprising:

3 a header data generating unit operable to write a  
4 specified time into a header of a pack, the specified time  
5 indicating a time when either a piece of picture data or an audio  
6 frame included in the pack is to be input to a decoding apparatus,  
7 wherein

8 when a difference between a presentation time of the  
9 audio frame and the specified time written in the header of the  
10 pack is lower than a certain value, the transfer control unit  
11 causes the stream data transfer unit to store the audio frame into  
12 the pack.

1 13. A system stream creating method for creating a system stream,  
2 the system stream being a sequence of fixed-length packs, each

3 pack storing a piece of video stream data, the video stream data  
4 being a sequence of picture data, the system stream creating  
5 method comprising:

6 a stream data transfer step for extracting a piece of  
7 picture data having a size of a payload from the video stream data  
8 and storing the piece of picture data into a fixed-length pack;

9 a condition judging step for judging, when a specified  
10 time, which indicates a time when the piece of picture data stored  
11 in a pack is to be input to a video decoder buffer of a decoding  
12 apparatus, is written in a header of the pack storing the piece of  
13 picture data, whether a difference between (1) a total number of  
14 pieces of picture data to be stored in the video decoder buffer up  
15 to the specified time and (2) a total number of pieces of picture  
16 data to be decoded by the decoding apparatus up to a unit time  
17 before the specified time has reached a predetermined value;

18 a specified time writing step for writing the specified  
19 time into the pack storing the piece of picture data when it is  
20 judged in the condition judging step that the difference has not  
21 reached the predetermined value; and

22 a specified time adjusting step for, when it is judged  
23 in the condition judging step that the difference has reached the  
24 predetermined value, updating the specified time, judging whether  
25 a difference between (1) a total number of pieces of picture data  
26 to be stored in the video decoder buffer up to the updated  
27 specified time and (2) a total number of pieces of picture data to

28 be decoded by the decoding apparatus up to a unit time before the  
29 updated specified time has reached the predetermined value, and  
30 when the judgement is made negatively, writing the updated  
31 specified time into the pack storing the piece of picture data.

1 14. A system stream creating method for creating a system stream,  
2 the system stream being a sequence of fixed-length packs, each  
3 pack storing a piece of video stream data, the video stream data  
4 being a sequence of picture data, the system stream creating  
5 method comprising:

6 a condition judging step for judging, when a piece of  
7 picture data having a size of payload is extracted from the video  
8 stream data in a video buffer and stored into a fixed-length pack,  
9 whether an amount of data stored in the video buffer would be  
10 lower than or equal to a predetermined value if the piece of  
11 picture data having the size of payload were stored into the video  
12 buffer, using a model of change in the amount of data stored in  
13 the video buffer, the model being made on an assumption that  
14 picture data is input to the video buffer every certain time and  
15 a piece of picture data included in each pack is output from the  
16 video buffer at a specified time written in a header of each  
17 pack;

18 a pack generation adjustment step for, when the  
19 condition judging step judges that the amount of data would exceed  
20 the predetermined value, updating a time when the piece of picture

21 data is to be input to a video decoder buffer of a decoding  
22 apparatus and judging whether the amount of data stored in the  
23 video buffer would be lower than or equal to the predetermined  
24 value;

25           a pack generation step for, when either the condition  
26 judging step or the pack generation adjustment step judges that  
27 the amount of data would be lower than or equal to the  
28 predetermined value, storing the piece of picture data into the  
29 pack, and writing a specified time into a header of the pack  
30 storing the piece of picture data based on a time when the piece  
31 of picture data is extracted from the video buffer, the specified  
32 time indicating a time when the piece of picture data is to be  
33 input to the video decoder buffer.

1 15. A system stream creating method for creating a system stream,  
2 the system stream being a sequence of fixed-length packs, each  
3 pack storing a piece of video stream data, the video stream data  
4 being a sequence of picture data, the system stream creating  
5 method comprising:

6           a video encoding step for generating picture data, and  
7 when having generated a last piece of picture data of a GOP,  
8 generating as many next start codes as correspond to remaining  
9 space of a pack which stores the last piece of picture data; and  
10           a stream data transfer step for storing either the  
11 picture data or the next start codes generated by the video

12 encoding unit into a fixed-length pack.

1 16. A system stream creating method for creating a system stream,  
2 the system stream being a sequence of fixed-length packs, each  
3 pack storing a piece of either video stream data or audio stream  
4 data, the video stream data being a sequence of picture data, the  
5 audio stream data being a sequence of audio frames, the system  
6 stream creating method comprising:

7 a header data generating step for writing a specified  
8 time into a header of a pack, the specified time indicating a time  
9 when a piece of picture data or an audio frame included in the  
10 pack is to be input to a decoding apparatus;

11 a condition judging step for judging whether a  
12 difference between a presentation time of the audio frame and the  
13 specified time written in the header of the pack is lower than a  
14 certain value; and

15 a stream data transfer step for extracting an audio  
16 frame from the audio stream data and storing the extracted audio  
17 frame into the pack when the condition judging step makes a  
18 positive judgement, and for extracting a piece of picture data  
19 having a size of a payload from the video stream data and storing  
20 the extracted picture data into the pack when the condition  
21 judging step makes a negative judgement.

1 17. A computer-readable record medium recording a program for

2 creating a system stream, the system stream being a sequence of  
3 fixed-length packs, each pack storing a piece of video stream  
4 data, the video stream data being a sequence of picture data, the  
5 program comprising:

6 a stream data transfer step for extracting a piece of  
7 picture data having a size of a payload from the video stream data  
8 and storing the piece of picture data into a fixed-length pack;

9 a condition judging step for judging, when a specified  
10 time, which indicates a time when the piece of picture data stored  
11 in a pack is to be input to a video decoder buffer of a decoding  
12 apparatus, is written in a header of the pack storing the piece of  
13 picture data, whether a difference between (1) a total number of  
14 pieces of picture data to be stored in the video decoder buffer up  
15 to the specified time and (2) a total number of pieces of picture  
16 data to be decoded by the decoding apparatus up to a unit time  
17 before the specified time has reached a predetermined value;

18 a specified time writing step for writing the specified  
19 time into the pack storing the piece of picture data when it is  
20 judged in the condition judging step that the difference has not  
21 reached the predetermined value; and

22 a specified time adjusting step for, when it is judged  
23 in the condition judging step that the difference has reached the  
24 predetermined value, updating the specified time, judging whether  
25 a difference between (1) a total number of pieces of picture data  
26 to be stored in the video decoder buffer up to the updated

27 specified time and (2) a total number of pieces of picture data to  
28 be decoded by the decoding apparatus up to a unit time before the  
29 updated specified time has reached the predetermined value, and  
30 when the judgement is made negatively, writing the updated  
31 specified time into the pack storing the piece of picture data.

1 18. A computer-readable record medium recording a program for  
2 creating a system stream, the system stream being a sequence of  
3 fixed-length packs, each pack storing a piece of video stream  
4 data, the video stream data being a sequence of picture data, the  
5 program comprising:

6       a condition judging step for judging, when a piece of  
7 picture data having a size of payload is extracted from the video  
8 stream data in a video buffer and stored into a fixed-length pack,  
9 whether an amount of data stored in the video buffer would be  
10 lower than or equal to a predetermined value if the piece of  
11 picture data having the size of payload were stored into the video  
12 buffer, using a model of change in the amount of data stored in  
13 the video buffer, the model being made on an assumption that  
14 picture data is input to the video buffer every certain time and  
15 a piece of picture data included in each pack is output from the  
16 video buffer at a specified time written in a header of each  
17 pack;

18       a pack generation adjustment step for, when the  
19 condition judging step judges that the amount of data would exceed

20 the predetermined value, updating a time when the piece of picture  
21 data is to be input to a video decoder buffer of a decoding  
22 apparatus and judging whether the amount of data stored in the  
23 video buffer would be lower than or equal to the predetermined  
24 value;

25           a pack generation step for, when either the condition  
26 judging step or the pack generation adjustment step judges that  
27 the amount of data would be lower than or equal to the  
28 predetermined value, storing the piece of picture data into the  
29 pack, and writing a specified time into a header of the pack  
30 storing the piece of picture data based on a time when the piece  
31 of picture data is extracted from the video buffer, the specified  
32 time indicating a time when the piece of picture data is to be  
33 input to the video decoder buffer.

1 19. A computer-readable record medium recording a program for  
2 creating a system stream, the system stream being a sequence of  
3 fixed-length packs, each pack storing a piece of video stream  
4 data, the video stream data being a sequence of picture data, the  
5 program comprising:

6           a video encoding step for generating picture data, and  
7 when having generated a last piece of picture data of a GOP,  
8 generating as many next start codes as correspond to remaining  
9 space of a pack which stores the last piece of picture data; and  
10           a stream data transfer step for storing either the

11 picture data or the next start codes generated by the video  
12 encoding unit into a fixed-length pack.

1 20. A computer-readable record medium recording a program for  
2 creating a system stream, the system stream being a sequence of  
3 fixed-length packs, each pack storing a piece of either video  
4 stream data or audio stream data, the video stream data being a  
5 sequence of picture data, the audio stream data being a sequence  
6 of audio frames, the program comprising:

7 a header data generating step for writing a specified  
8 time into a header of a pack, the specified time indicating a time  
9 when a piece of picture data or an audio frame included in the  
10 pack is to be input to a decoding apparatus;

11 a condition judging step for judging whether a  
12 difference between a presentation time of the audio frame and the  
13 specified time written in the header of the pack is lower than a  
14 certain value; and

15 a stream data transfer step for extracting an audio  
16 frame from the audio stream data and storing the extracted audio  
17 frame into the pack when the condition judging step makes a  
18 positive judgement, and for extracting a piece of picture data  
19 having a size of a payload from the video stream data and storing  
20 the extracted picture data into the pack when the condition  
21 judging step makes a negative judgement.